CLAIMS

1. A vehicle system to predict cylinder air flow (CAF) into engine cylinders, comprising:

a throttle position sensor that generates a current throttle position signal (TPS);

a mass air flow (MAF) sensor that generates a current actual MAF signal;

a manifold absolute pressure (MAP) sensor that generates a current actual MAP signal; and

a controller that determines a current estimated CAF signal, determines an MAF transient signal, determines a MAP transient signal, and determines a predicted CAF signal into said engine based on said current estimated CAF signal, said current actual MAF signal, said current MAP signal, said current TPS signal, said MAF transient signal, and said MAP transient signal.

2. The vehicle system of claim 1 wherein said MAF transient signal is based on a pre-defined MAF gain limit.

3. The vehicle system of claim 1 wherein said MAP transient signal is based on a pre-defined MAP gain limit.

4. The vehicle system of claim 1 wherein said MAF transient signal is based on said current actual MAF signal and a prior actual MAF signal.

5. The vehicle system of claim 4 wherein said controller sets said MAF transient signal to zero if said MAF gain limit is less than a difference between said current actual MAF signal and said prior actual MAF signal.

6. The vehicle system of claim 4 wherein said MAF transient signal is based on a difference between said current actual MAF signal, said prior actual MAF signal, and said MAF gain limit if said MAF gain limit is greater than a difference between said current actual MAF signal and said prior actual MAF signal.

7. The vehicle system of claim 1 wherein said MAP transient signal is based on said current actual MAP signal and a prior actual MAP signal.

8. The vehicle system of claim 7 wherein said controller sets said MAP transient signal to zero if said MAP gain limit is less than a difference between said current actual MAP signal and said prior actual MAP signal.

9. The vehicle system of claim 7 wherein said MAP transient signal is based on a difference between said current actual MAP signal, said prior actual MAP signal, and said MAP gain limit if said MAP gain limit is greater than a difference between said current actual MAP signal and said prior actual MAP signal.

10. The vehicle system of claim 1 wherein said controller schedules a select set of model coefficients based on a measured engine parameter and determines said predicted CAF signal based on said select set of model coefficients.

11. The vehicle system of claim 10 wherein said select set of model coefficients is based on engine speed (RPM).

12. The vehicle system of claim 10 wherein said select set of model coefficients is based on MAP.

13. The vehicle system of claim 1 wherein said controller operates said engine based on said current estimated CAF signal.

14. The vehicle system of claim 1 wherein said controller determines said current estimated CAF signal based on a prior predicted CAF signal.

15. A method of operating an engine based on predicted cylinder air flow (CAF), comprising:

determining a current estimated CAF signal into said engine based on a prior predicted CAF signal;

calculating a mass air flow (MAF) transient signal based on a pre-defined MAF gain limit;

calculating a manifold absolute pressure (MAP) transient signal based on a pre-defined MAP gain limit;

generating a current predicted CAF signal into said engine based on said current estimated CAF signal, said MAF transient signal, and said MAP transient signal; and

operating said engine based on said current estimated CAF signal and said current predicted CAF signal.

16. The method of claim 15 further comprising:

generating a current actual MAF signal into said engine;

generating a current actual MAP signal of said engine;

sending a current throttle position (TPS) signal; and

determining said current predicted CAF signal based on said current actual MAF signal, said current actual MAP signal, and said current TPS signal.

17. The method of claim 16 wherein said MAF transient signal is based on said current actual MAF signal and a prior actual MAF signal.

18. The method of claim 17 further comprising setting said MAF transient signal to zero if said MAF gain limit is less than a difference between said current actual MAF signal and said prior actual MAF signal.

19. The method of claim 17 further comprising setting said MAF transient signal as a difference between said current actual MAF signal, said prior actual MAF signal, and said MAF gain limit if said MAF gain limit is greater than a difference between said current actual MAF signal and said prior actual MAF signal.

20. The method of claim 16 wherein said MAP transient signal is based on said current actual MAP signal and a prior actual MAP signal.

21. The method of claim 20 further comprising setting said MAP transient signal to zero if said MAP gain limit is less than a difference between said current actual MAP signal and said prior actual MAP signal.

22. The method of claim 20 further comprising setting said MAP transient signal as a difference between said current actual MAP signal, said prior actual MAP signal, and said MAP gain limit if said MAP gain limit is greater than a difference between said current actual MAP signal and said prior actual MAP signal.

23. The method of claim 15 further comprising:

scheduling a select set of model coefficients based on a measured engine parameter; and

determining said predicted CAF signal based on said select set of model coefficients.

24. The method of claim 23 wherein said select set of model coefficients is based on engine speed.

25. The method of claim 23 wherein said select set of model coefficients is based on MAP.

26. A method of predicting cylinder air flow (CAF) into engine cylinders, comprising:

determining a current estimated CAF signal into said engine;

generating a current actual mass air flow (MAF) signal into said engine;

generating a current actual manifold absolute pressure (MAP) signal of said engine;

sending a current throttle position (TPS) signal;

calculating an MAF transient signal based on a pre-defined MAF gain limit;

calculating an MAP transient signal based on a pre-defined MAP gain limit; and

determining a predicted CAF signal into said engine based on said current estimated CAF signal, said current actual MAF signal, said current MAP signal, said current TPS signal, said MAF transient signal, and said MAP transient signal.

27. The method of claim 26 further comprising controlling operation of said engine based on said current estimated CAF signal.

28. The method of claim 26 further comprising determining said current estimated CAF signal based on a prior predicted CAF signal.

29. The method of claim 26 wherein said MAF transient signal is based on said current actual MAF signal and a prior actual MAF signal.

30. The method of claim 29 further comprising setting said MAF transient signal to zero if said MAF gain limit is less than a difference between said current actual MAF signal and said prior actual MAF signal.

31. The method of claim 29 further comprising setting said MAF transient signal as a difference between said current actual MAF signal, said prior actual MAF signal, and said MAF gain limit if said MAF gain limit is greater than a difference between said current actual MAF signal and said prior actual MAF signal.

32. The method of claim 26 wherein said MAP transient signal is based on said current actual MAP signal and a prior actual MAP signal.

33. The method of claim 32 further comprising setting said MAP transient signal to zero if said MAP gain limit is less than a difference between said current actual MAP signal and said prior actual MAP signal.

34. The method of claim 32 further comprising setting said MAP transient signal as a difference between said current actual MAP signal, said prior actual MAP signal, and said MAP gain limit if said MAP gain limit is greater than a difference between said current actual MAP signal and said prior actual MAP signal.

35. The method of claim 26 further comprising:

scheduling a select set of model coefficients based on a measured engine parameter; and

determining said predicted CAF signal based on said select set of model coefficients.

36. The method of claim 35 wherein said select set of model coefficients is based on engine speed.

37. The method of claim 35 wherein said select set of model coefficients is based on MAP.